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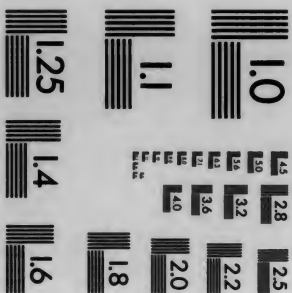
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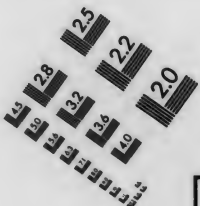
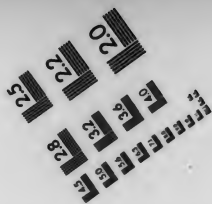
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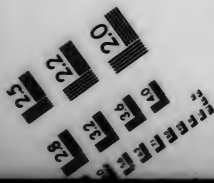
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KNITTED-OUTERWEAR MACHINERY IN CLEVELAND

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WILLIAM L. COOPER, Director

Domestic Commerce Series—No. 47

KNITTED-OUTERWEAR
MACHINERY
IN CLEVELAND



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FOREWORD

The study of machinery in the American knitted-outerwear industry was begun in Philadelphia, and the results of the survey made in that city have already been published.¹ Last year it was extended to Cleveland, with the collection of data similar to those collected in Philadelphia. Fifteen plants, representing practically the whole of Cleveland's knitted-outerwear production, furnished data. This series of surveys aims to help knitted-outerwear manufacturers to evolve an equipment policy that will eliminate waste and improve the quality of the products of the industry.

Ratings of the knitting machines in Cleveland were supplied by the committee which cooperated with the Department of Commerce. They indicate the opinion of experts in the industry. The standards used by these experts in connection with a careful analysis of the machines whose products were most modern and which suffered least from idleness gives a concrete indication of what machines are the most adequate for knitted-outerwear production, as found at the time studied. They should be useful to individual knitted-outerwear manufacturers who resolve to make a scientific study of their own plants to see if their machinery is equipped to produce what they would like to have it produce, and at the minimum cost.

To the extent that this study concerns itself with differences in individual knitting machines and in types of machines, it is, of course, largely technical and adapted to use only by the knitting industry. But it is hoped that what is perhaps just as important a part of the study—its emphasis on the need of careful adaptation of machine equipment in an individual plant to turn out the most up-to-date and salable product—may have useful application to all industries affected by frequent style changes in their products.

In making the Cleveland study, as in making the Philadelphia study, the Department of Commerce had the cooperation of Ellery B. Gordon, secretary of the National Knitted Outerwear Association, and a committee representing that association headed by Bernard Steuer, which decided on the nature of the data to be gathered and estimated the degree of obsolescence of each machine in the survey. Manufacturers of knitting machines also cooperated by furnishing data on the ages of the greater part of the domestically made knitted-outerwear machines used in Cleveland. The present report was prepared in the merchandising research division of the Bureau of Foreign and Domestic Commerce, with the cooperation of the industrial machinery division.

WILLIAM L. COOPER, *Director,*
Bureau of Foreign and Domestic Commerce.

APRIL, 1931.

¹ "Knitted-Outerwear Machinery in Philadelphia," Domestic Commerce Series No. 35, Bureau of Foreign and Domestic Commerce. For sale by the Superintendent of Documents, Washington, at 10 cents per copy.

KNITTED-OUTERWEAR MACHINERY IN CLEVELAND

OBSOLESCENCE IN KNITTED-OUTERWEAR MACHINERY

RATING OF THE MACHINES

As in the case of the Philadelphia survey, a committee of manufacturers representing the knitted-outerwear industry rated each machine covered by the Cleveland survey, using for the purpose the data collected in the survey. In arranging the data for the use of the committee, care was taken that the activities of individual manufacturers should not be disclosed. The Bureau of Foreign and Domestic Commerce did not participate in working out these ratings, and the publication of them in this study should not be construed as involving the bureau's approval of them. They represent the judgment of knitted-outerwear manufacturers conversant with the details of the fabric being produced and with the various models of machinery available to the industry for such production.

The basis for the Cleveland ratings differs considerably from that used for the Philadelphia ratings. The Philadelphia machines were rated in direct relation to (1) whether or not they could produce as cheaply as other available machines, (2) whether or not their products were still in full demand, and (3) their age. On the other hand, in rating Cleveland's circular and flat machines age was entirely ignored, and less consideration was given to the make and style of the product being made at the time of the survey than in the case of the Philadelphia machines. Instead, the committee considered mainly the degree to which the machines were equipped with attachments ensuring flexibility of pattern and fabric plus economy of operation.

In rating the Cleveland Raschel machines, however, the main criterion was age. Raschel machines were rated as follows: Less than 10 years old, 75 per cent; 10 to 20 years old, 50 per cent; over 20 years old, 25 per cent. Kettenstuhl machines were all rated arbitrarily at 15 per cent. The basis for rating the different makes of circular machines is described in greater detail on pages 6 to 11.

The Philadelphia and Cleveland ratings are summarized in Table A. A detailed discussion of these ratings is superfluous. The lowness of the ratings of the great majority of the machines in both cities is apparent at a glance. Suffice it to say that more than half the machines have been rated at 50 per cent or less.

There was a great variation in the ratings among individual plants in Cleveland, as summed up for circular and flat machines in Table B. This table covers only the nine largest plants in Cleveland, six plants with less than 50 machines each (including Raschel and Kettenstuhl) being excluded. Note, for instance, how much higher plant 6 rates in circular machines, and plant 3 in flat machines than do the other plants.

TABLE A.—RATINGS OF PHILADELPHIA AND CLEVELAND MACHINES

Philadelphia			Cleveland				
Rating	Circular	Flat	Rating	Circular	Flat	Raschel	Kettenstuhl
0 per cent.	27	59	0 per cent.	5			
5 per cent.	233	263	1 to 10 per cent.	64	69		15
7½ per cent.	72		11 to 20 per cent.	32	151	121	
10 per cent.	105		21 to 30 per cent.	82	71		
15 per cent.	101	51	31 to 40 per cent.	123	17	93	
20 per cent.	371	44	41 to 50 per cent.	410	16		
25 per cent.	99	1	51 to 60 per cent.	483	21		
30 per cent.	27	2	61 to 70 per cent.	31	5	50	
35 per cent.	24	2	71 to 80 per cent.	93			
40 per cent.	12	5	81 to 90 per cent.	69			
50 per cent.	3		91 to 99 per cent.	16			
65 per cent.	47		100 per cent.	21		2	
75 per cent.	26		Unknown	1	3		
Unknown	6	20					
Total	1,153	451	Total	1,430	353	266	15

TABLE B.—CIRCULAR AND FLAT MACHINES IN NINE LARGEST KNITTED-OUTERWEAR PLANTS IN CLEVELAND GRADED ACCORDING TO RATING

[Based on per cent of total machines of each type in each plant]

Plant	Circular machines—Rating (per cent)				Flat machines—Rating (per cent)		
	0-30	31-60	61-90	91-100	0-30	31-60	61-90
No. 1.	16	66	18		74	21	5
No. 2.	14	67	17	2	68	32	
No. 3.	19	70	10	1	23	47	30
No. 4.	1	95	2	2	49	35	6
No. 5.	28	52	19	1	72	25	3
No. 6.		26	74		80	11	9
No. 7.	7	74	10	9	89	11	
No. 8.	18	69	7	3	11	89	
No. 9.	2	92	3				

THE TWO KINDS OF OBSOLESCENCE

The Cleveland survey has demonstrated that, to understand the conditions which have led to the situation indicated by the ratings, it is necessary to make a practical distinction between two kinds of obsolescence, which may be termed mechanical obsolescence and style obsolescence. These terms as here used mean the following: When a machine is superseded by a new model which can produce the same product as the old machine cheaper than the latter, then the old machine is suffering from mechanical obsolescence. This kind of obsolescence may equally well be termed technological or cost obsolescence. When, on the other hand, the type of product which the old machine can produce has gone wholly or partially out of style and machines are available which can produce a more up-to-date product, then the old machine is suffering from style obsolescence. This may equally well be termed product obsolescence.

STYLE OBSOLESCENCE

The data obtained so far on knitted-outerwear machines indicate that the problem of handling style obsolescence is probably more

important in the knitted-outerwear industry than the problem of handling mechanical obsolescence. The testimony of American knitting-machine manufacturers is significant in this regard. After the Cleveland survey, the principal manufacturers of circular knitting machines were solicited for their records as to the exact total ages of the machines used in Cleveland and for information regarding possible later models which might supersede or displace the old machines.

The constantly changing styles in knitted garments require a constant adaptation of existing machinery to new developments in the pattern or the stitch of the knitted garment. Sometimes when a new style appears the old machines may be capable of producing the new style without being radically changed. Sometimes they may need alteration in some way. In other instances it will be necessary to purchase entirely new machines. Following are a few quotations from leading knitting-machine manufacturers relative to the machines of their makes in use in Cleveland.

One manufacturer says: "The majority of these machines are used now for the same class of work as when built and, as they have a wide range of usage, it is impossible to say whether another class of machine would perform the work more efficiently than the old machine unless the exact class of work manufactured were known."

Another says: "Have been no major improvements. Most changes in machines are in the fineness and such changes may not be required in the goods manufactured in the plants where our machines are now being used. New models are also built to make fancy designs in greater ranges than were possible with the old models. Some recent models have a greater number of feeds than the old machines and thus permit a larger output and a greater range of patterns and colors."

Another manufacturer states: "It would be very difficult to give information regarding superseding models, as we seldom have a superseding model. When there is no demand for a certain type of machine, something different is manufactured which perhaps would not be like anything previously sold, while at times models are changed only slightly."

Another states: "The mills in Cleveland all use practically the same type of machine of our make, and while there have been no radical changes in recent years, there have been various attachments or changes in type which would not constitute improvements, merely changing them to meet the changing demands of the trade. At the present time practically every mill in Cleveland has ordered extra parts for these machines in order to make a new style of garment for which an active demand has arisen within the past couple of weeks. This, however, does not constitute an improvement."

Still another manufacturer says: "There was practically no change in the machines from date of manufacture up to the latest machine which we manufacture."

Only one machine manufacturer, with relatively few machines in use in Cleveland, states that a recent improvement in his model has made all the machines of his old model obsolete.

In other words, in trying to figure what, if anything, can be done about the possible obsolescence of any machine, one almost always finds that the style or quality of the product of the machine has a great deal to do with determining the answer.

Even though the machine makers seldom bring out a new model which definitely supersedes an old one, nevertheless, the changes they make in their models are, because of the effect of these changes on style of products, speed of operation, etc., often important enough to require the machine users either to purchase a new model or drastically to rebuild their old machines. Therefore, these excerpts from the machine makers' letters should not be interpreted as meaning that a knitted-outerwear manufacturer does not need to be on the alert to keep his machinery up to date. They merely emphasize the importance of changes in the styles of knitted outerwear in bringing about machine obsolescence.

TABLE C.—PER CENT TO WHICH PRODUCTS OF CLEVELAND MACHINES WERE IN DEMAND AT TIME OF SURVEY COMPARED WITH DEMAND WHEN MACHINES WERE INSTALLED

Per cent product still in demand	Circular	Flat	Raschel	Kettenstuhl	Per cent product still in demand	Circular	Flat	Raschel	Kettenstuhl
0.....	26			1	71 to 80.....	76		141	
1 to 10.....	42				81 to 90.....	2	12		5
11 to 20.....	87	12			91 to 100.....	540	220	82	10
21 to 30.....	142	22			150.....	20			
31 to 40.....	18				200.....	56	26	42	
41 to 50.....	354	60			Unknown.....				
51 to 60.....	17				Total.....	1,430	353	266	15
61 to 70.....	12	1							

The information furnished by knitted-outerwear manufacturers is also testimony to the important rôle played by style obsolescence. The most direct evidence of this is embodied in Table C, which shows to what extent the products of the circular machines used in Cleveland were still in style in the spring of 1930, when the Cleveland survey was made. In this table 100 per cent has been taken as the amount of the demand for the product of each machine at the time the machine was installed in the plant where it was at the time of the survey. Percentages less than 100 per cent, therefore, mean a decline in demand for the products of the machines in question. Thus, 25 per cent, for instance, for a machine means that at the time of the survey the demand for the various possible products of the machine was only one-fourth as great as when the machine was installed in the plant. However, cyclical variations have been eliminated. That is, only the general trend in decline of demand is shown, the effect of any temporary depression which may have existed at the time the survey was made not being taken into account. Of course, the percentages are only estimates. They mean nothing more than an approximation by a plant executive or knitting foreman as to the comparison of the present market demand for the products of his various machines with what it used to be when the machines were purchased. But on the whole they probably represent reasonably accurate estimates, when one considers that they were made by the persons who presumably knew best the nature of the products of the individual machines and of the variety of products which those individual machines were capable of turning out.

Table C shows great decreases in the demand for the products of many of the machines, particularly of the circular machines. The demand for the products of at least half of the circular machines had

decreased by 50 per cent or more since the machines were installed. Moreover, it must be remembered that some of these machines had been purchased second hand, and the demand for their products may quite likely have declined before they were installed in their present plant. The demand for the products of the flat and Raschel machines had decreased considerably less.

MECHANICAL OBSOLESCENCE

Mechanical obsolescence is often more difficult to recognize in individual instances than style obsolescence as a factor in causing knitting machines to go out of date. To be mechanically obsolete, a machine must have been superseded by one that can turn out the same product at a lower cost. It is essential, in measuring mechanical obsolescence, that the products of the machines compared be exactly the same.

In the knitted-outerwear industry, as already indicated, it very seldom happens that an old machine is superseded by a new one that turns out exactly the same kind of fabric and has the same flexibility and variety of product as the old machine. As everyone in the knitting industry knows, when a machine of one model is superseded by another, the two models are very likely to differ somewhat in the types of fabrics they can produce. For instance, there are authorities who believe that flat machines and also Raschel machines as a class are less economical to operate than circular machines; in one plant surveyed, it was discovered that a circular Jacquard machine working alongside a flat Jacquard machine had an output four times the latter, with a cost of production, consequently, considerably less per unit of output. However, it was stated in the plant that the quality of the product of the flat machine was better than that of the circular machine. Moreover, some plant foremen stated that though flat machines are slow, they are needed particularly to produce trimmings of a certain type to which circular machines are less well adapted. Other factors also, such as the relative amounts of wastage, obscure the comparison. It was discovered in the two surveys that it is very difficult to find two different models of machines producing exactly the same thing and yet differing greatly in cost of output. At any rate, if cases of pure mechanical obsolescence of this type can be found, they are so few that it is very hard to lay down any general rules for discovering the extra burden of cost of production which they entail.

OBSOLESCENCE A PROBLEM FOR THE INDIVIDUAL PLANT

Obsolescence is likely to be present, in one form or another, in every plant, but in most instances it is only the individual plant owner who is in a position to identify it. Obviously it is out of the question for a nontechnical agency like the Bureau of Foreign and Domestic Commerce to make detailed comparisons between different makes of machines and to reach conclusions relative to the effect of differences in small things like the number of feeds, the number of stripper changes, the number of needles per inch, etc., even if it were not outside the province of a governmental agency to compare the merits of the products of individual manufacturers in the United States.

Not only does the constant competition to produce something new contribute toward making each manufacturer's machine problem an

individual one, but permanent differences in the size of plants and their types of customers make great differences in the types of knitting machinery that different outerwear manufacturers can most advantageously use. Compare, for instance, a plant of five or six stories, covering a large city block and containing hundreds of machines working on fancy sweaters of the latest style, with a plant occupying a corner of one floor of a building and turning out Spanish-type shawls for the ladies of the Southwest and of Mexico. Plainly, their machinery demands will differ as to kind of stitch, quality, and durability of product, flexibility of pattern, speed of operation, etc. The small plant may be in a position to put secondhand machines to much more effective use than the large plant. Between these two extremes there are all gradations of machinery problems.

WHERE TO LOOK FOR OBSOLESCENCE

On the basis of the data obtained in the surveys, the following suggestions are made to knitted-outerwear manufacturers to assist them in determining whether their machines are doing what they should be doing.

COMPARATIVE MERITS OF CIRCULAR, FLAT, AND RASCHEL MACHINES

First the efficiency relative to each other of the main classes of machines—circular, flat, and Raschel—ought to be studied more carefully as applied to certain lines of work for which some manufacturers now use mainly one class and others mainly another.

Many manufacturers devote separate departments to the production of trimmings on flat machines, stating that although the cost of operating these machines may be great, owing to the amount of space they take and their slowness, compared with circular machines they are indispensable because they are so well adapted to knitting trimmings of any size and shape and of all arrangements of selvage (finished edge). On the other hand, some experienced knitted-outerwear manufacturers believe that flat machines as a whole are practically obsolete.

COMPARATIVE MERITS OF DIFFERENT TYPES OF CIRCULAR MACHINES

The second important step is a detailed study of different types of circular machines. The most definite available measure of machine obsolescence in Cleveland is the committee's ratings.

Before discussing the ratings, the basis of computing them needs to be described in some detail. Four main types of circular machines were taken as the starting point—ribber, racker, jersey, and hockey machines. These four types were regarded by the committee as likely to remain standard types and as equal in utility and importance. An ideal or 100 per cent machine of each type was specified, and the rating of each actual machine of that type was determined by the degree to which that machine fell short of equaling the ideal machine.

In making the computation, the committee set up a schedule of percentage deductions to be made from the rating of a machine on account of the lack by that machine of stated equipment possessed by the ideal machine. These deductions were made progressively; for instance, if a ribber machine was less than 9 inches in diameter, 10 per cent was deducted from its rating, leaving 90 per cent. If it also had less than 5 needles per inch, 20 per cent more was deducted, the

20 per cent being applied to the 90 per cent, leaving 72 per cent net. If the machine had no striper changes, it lost an additional 25 per cent (applied to the 72 per cent), leaving 54 per cent, and so on.

The hockey machine was not regarded by the committee as the equal of the other types. The committee gave the ideal hockey machine a 50 per cent rating, apparently regarding the type itself as obsolete.

Machines of the Jacquard type were all given an arbitrary rating of 70 per cent. No schedule of deductions was worked out for them.

Below will be found a detailed classification of circular machines as adopted for rating purposes and a schedule of deductions as formulated and used by the committee.

CLASSIFICATION OF TYPES OF CIRCULAR MACHINES

Hockey machines.....	Machines with a ribbed stitch especially built to make hockey caps and not readily adaptable to making other products (no machines with a jersey stitch included).
Racker machines.....	Machines with a rack stitch, other than hockey machines.
Ribber machines.....	Machines with a ribbed stitch, other than racker and hockey machines.
Jersey machines.....	Machines with a jersey (flat) stitch.
Jacquard machines.....	Machines which can make geometric patterns of any size, shape, or color symmetrically and uniformly.

DESCRIPTION AND RATING OF IDEAL MACHINE IN EACH TYPE

Type	Rating (per cent)	Diameter (inches)	Needles per inch	Number of feeds	Striper changes	With pattern wheel	Make
Hockey.....	50	(1).....	8 and up..	(1).....	1 and up..	(1).....	All makes.
Racker.....	100	16 and up.	7 and up..	(1).....	3 and up..	Yes.....	Only certain makes. ¹
Ribber.....	100	do.....	5 and up..	4 and up..	1 and up..	Yes.....	All makes.
Jersey.....	100	18 and up.	12 and up.	7 and up..	do.....	Yes.....	Only certain makes. ²

¹ Not specified.

² For the other makes there is no 100 per cent machine, according to the committee.

SCHEDULE OF PROGRESSIVE DEDUCTIONS FOR COMPUTING RATINGS

Hockey machines:	Per cent
Less than 8 needles per inch.....	10
Without striper changes.....	20
Racker machines:	
Diameter—	
14-9 inches.....	5
Less than 9 inches.....	10
Needles per inch—	
6-5 needles.....	10
Less than 5 needles.....	20
Striper changes—	
2 changes.....	10
1 change.....	15
0 change.....	20
Without pattern wheel.....	20
Lack of prime quality of construction in certain makes.....	10-20
Ribber machines:	
Diameter—	
14-9 inches.....	5
Less than 9 inches.....	10
Less than 5 needles per inch.....	20
2 feeds.....	25
Without striper changes.....	25
Without pattern wheel.....	25

Jersey machines:	Per cent
Diameter—	5
17-16 inches.....	20
Less than 16 inches.....	
Needles per inch—	5
11-10 needles.....	15
Less than 10 needles.....	
Feeds—	20
6-5 feeds.....	40
4-3 feeds.....	60
2-1 feeds.....	50
Without striper changes.....	50
Without pattern wheel.....	20-50
Lack of prime quality of construction in certain makes.....	

TABLE D.—CIRCULAR MACHINES CLASSIFIED ACCORDING TO RATING

Rating	Total number	Type				
		Ribber	Racker	Jersey	Jacquard	Unknown
0 per cent.....	5	4	7	1		2
1 to 10 per cent.....	64	16	2	30		
11 to 20 per cent.....	33	2	37	42		
21 to 30 per cent.....	82	3	1	11		
31 to 40 per cent.....	124	111	182	23		
41 to 50 per cent.....	410	205	104	52	1	
51 to 60 per cent.....	481	326	18	4	9	
61 to 70 per cent.....	31	4	65	16		
71 to 80 per cent.....	93	83	4	21		
81 to 90 per cent.....	69	16		1		
91 to 99 per cent.....	21					
100 per cent.....	1					
Unknown.....						
Total.....	1,430	758	420	240	10	2

TYPES OF CIRCULAR MACHINES SHOWING THE GREATEST OBSOLESCENCE

In tabulating and analyzing the results of computing ratings by the system described above, it was deemed desirable to drop the hockey machine classification. There were two reasons for this. First, the hockey machines start with a rating of only 50 per cent for the best machines of that type, whereas our purpose here is to compare the existing machines of any type with a 100 per cent machine of that type. Secondly, the hockey machines cut right across the ribber and racker machine classifications anyhow and can just as easily be classified as ribber or racker.

Table D shows the ratings given the various types, classifying the hockey machines as ribber or racker according to their stitch. The following table summarizes Table D in percentage figures:

Rating (per cent)	Per cent of total machines of each type			
	Ribber	Racker	Jersey	Jacquard
01 to 30.....	3	11	47	10
31 to 60.....	85	68	36	90
61 to 90.....	12	21	2	
91 to 100.....			15	
Total.....	100	100	100	100

Jacquard machines rank first, but inasmuch as there are only 10 Jacquard machines in Cleveland, their position may be regarded as a special one. Practically half of the jersey machines rank no higher than 30 per cent. Next come the ribber machines of which 85 per cent rank from 31 to 60 per cent in rating. Fifteen per cent of the jersey machines rank from 91 to 100 per cent in rating.

The analysis of circular knitting machines in Cleveland may be summed up, then, as follows:

1. Under the system used by the rating committee, whether a circular machine is adequate for knitting outerwear depends mainly on whether its diameter and its number of needles per inch are within certain ranges, whether it is equipped with feeds, striper changes, and pattern wheels, and by whom it was made.

2. Tabulating the committee's opinions as expressed in the ratings shows that the greatest obsolescence in the Cleveland circular machines exists in the jersey machines, but that the best jersey machines (a relatively small number) are the best machines of all; that the ribber machines on the whole rank fairly low; that the racker machines have the highest average rank of any of the three important classes, ribber, racker, and jersey; and that the 10 Jacquard machines in Cleveland average higher than any of the three large classes.

RATINGS IN RELATION TO ACTIVITY AND DEMAND FOR PRODUCT

The general tendencies, if any, for demand for the product and for activity of machines to vary with ratings are shown in Tables E and F. Both of the tables show a diagonal zone of concentration extending from the upper left-hand corner to the lower right-hand corner. The exceptions, as would be expected, are numerous. But even recognizing the many important exceptions, these two tables definitely indicate that the committee's rating system, though based solely on mechanical considerations, tended to give the highest ratings to the machines with the most marketable products and the greatest ability to stay active.

TABLE E.—CIRCULAR MACHINES WITH DIFFERENT RATINGS CLASSIFIED ACCORDING TO PER CENT PRODUCT STILL IN DEMAND

Rating	Total number	Per cent product still in demand																Unknown
		0	1-10	11-20	21-30	31-40	50	60	65	75	85	100	150	200				
0 per cent.....	5	5																
1 to 10 per cent.....	64		14	4	5		6	8		7		19						1
11 to 20 per cent.....	32		3				1			3		25						
21 to 30 per cent.....	82		7	1			43			12		8	1					10
31 to 40 per cent.....	123		1	2			50			4		63	1					2
41 to 50 per cent.....	410			3	56	103		97	2			123	1					18
51 to 60 per cent.....	483		6	21	23	34	4	150	7		16	187	12	4				19
61 to 70 per cent.....	31						1			2		27						1
71 to 80 per cent.....	93		4		4		14	6		12	29	19						5
81 to 90 per cent.....	69			1			30			1		37						
91 to 99 per cent.....	16										2	5	4					
100 per cent.....	21											20						
Unknown.....	1											1						
Total.....	1,430	26	42	87	142	18	384	17	12	76	2	540	20	8				56

TABLE F.—CIRCULAR MACHINES WITH DIFFERENT RATINGS CLASSIFIED ACCORDING TO PER CENT OF NORMAL WORKING TIME USED, 1929

Rating	Total number	Per cent of time used														Purchased since 1920
		0	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	120			
0 per cent.....	5	5								8						
1 to 10 per cent.....	64	15	7	4	15	15					2					
11 to 20 per cent.....	37	4	9		9		1	3		4	9	1				
21 to 30 per cent.....	82	7	2		8	45	6			35	26	3				
31 to 40 per cent.....	123	1	3		2	18	35			63	86	8	5		1	
41 to 50 per cent.....	410	54	1	42	81	38	21	10	63	85	14	40	23	8		
51 to 60 per cent.....	483	34	6	42	32	64	96	17	22	85	14	40	23	8		
61 to 70 per cent.....	31	3	1			1	3			8		9	2	5		
71 to 80 per cent.....	93		5	6		2	49	13	6	34		10				
81 to 90 per cent.....	69	1	1			4	12	1		2	4	5	5			
91 to 99 per cent.....	16					3		7	3		5	3				
100 per cent.....	21					1										
Unknown.....	1															
Total.....	1,430	124	35	94	155	183	224	56	94	269	60	82	35		19	

Tables G and H show what types of machines had suffered the least decline in demand for their products and what types were the most active in 1929. The figures of Table G are conveniently summed up in percentage form in the following table, which compares the extent to which the products of the different types are up to date:

Product still in demand	Per cent of total machines of each type			
	Ribber	Racker	Jersey	Jacquard
Up to 40 per cent.....	37	1	17	
50 per cent.....	29	39	7	100
60 to 85 per cent.....	26	57	60	
100 per cent and over.....				
Total.....	100	100	100	100

TABLE G.—CIRCULAR MACHINES OF DIFFERENT TYPES, CLASSIFIED ACCORDING TO PER CENT PRODUCT STILL IN DEMAND

Product still in demand	Total number	Ribber	Racker	Jersey	Jacquard	Unknown
0 per cent.....	26	14		12		2
1 to 10 per cent.....	42	27		12		
11 to 20 per cent.....	87	83	1	4		
21 to 30 per cent.....	142	132	1	9		
31 to 40 per cent.....	18	18				
50 per cent.....	384	208	160	16		
60 per cent.....	17	9		8		
65 per cent.....	12	12				
75 per cent.....	76	39	13	24		
85 per cent.....	2	188	232	10		
100 per cent.....	540	5		15		
150 per cent.....	20			8		
200 per cent.....	8			20		
Unknown.....	56	23	13			
Total.....	1,430	758	420	240	10	2

TABLE H.—CIRCULAR MACHINES OF DIFFERENT TYPES, CLASSIFIED ACCORDING TO PER CENT OF NORMAL WORKING TIME USED, 1929

Time operated	Total number	Ribber	Racker	Jersey	Jacquard	Unknown
0 per cent.....	124	94	6	22		2
1 to 10 per cent.....	35	19		15		
11 to 20 per cent.....	94	90		4		
21 to 30 per cent.....	155	100	1	54		
31 to 40 per cent.....	183	76	83	24		
41 to 50 per cent.....	224	173	38	11	1	
51 to 60 per cent.....	56	22	16	18		
61 to 70 per cent.....	94	26	62	6		
71 to 80 per cent.....	269	104	147	18		
81 to 90 per cent.....	60	31		29		
91 to 100 per cent.....	82	21	26	27	8	
120 per cent.....	35		23	12		
Purchased since 1929.....	19	1	18			
Total.....	1,430	758	420	240	10	2

The following table sums up Table H in percentages:

Time operated, 1929	Per cent of total machines of each type			
	Ribber	Racker	Jersey	Jacquard
Up to 30 per cent.....	40	2	39	10
31 to 60 per cent.....	36	33	22	10
61 per cent and over.....	24	65	39	80
Total.....	100	100	100	100

¹ Including those purchased since 1929.

THE POSITION OF TRIMMING MACHINES

Of course, the Cleveland rating system, which is based largely on the flexibility of pattern and fabric which a machine can produce, assumes that it is always desirable for a machine to be able to produce a great variety of patterns and of fabrics. But there are certain types of products which do not require such flexibility of machines, particularly trimmings. A machine with relatively little ability to vary its pattern may, if needed solely for making trimmings in a given plant, be quite as useful for its purpose as a machine with maximum flexibility. In this connection, it is helpful to note the ratings, demand data, and activity of the circular machines making trimmings, in comparison with circular machines in general.

The following statement shows circular trimming machines according to ratings.

Machines		Machines	
0 per cent.....	1	51 to 60 per cent.....	52
1 to 10 per cent.....	18	61 to 70 per cent.....	2
11 to 20 per cent.....	2	71 to 80 per cent.....	3
21 to 30 per cent.....	6	Unknown.....	1
31 to 40 per cent.....	46		
41 to 50 per cent.....	39	Total.....	170

If one compares these ratings with the ratings of the circular machines in general on page 8, it will be seen that they are very low. There are practically no trimming machines rated above 60 per cent,

and yet these machines ran better than the circular machines in general, as shown in the following table:

Time operated, 1929	Machines	Product still in demand	Machines
0 per cent.....	15	0 per cent.....	2
1 to 10 per cent.....	5	1 to 10 per cent.....	10
11 to 20 per cent.....	4	11 to 20 per cent.....	3
21 to 30 per cent.....	10	30 per cent.....	74
31 to 40 per cent.....	35	75 per cent.....	4
41 to 50 per cent.....	48	100 per cent.....	62
51 to 60 per cent.....	21	Unknown.....	15
61 to 70 per cent.....	8		
71 to 80 per cent.....	1		
81 to 90 per cent.....	1		
91 to 100 per cent.....	23		
Total.....	170	Total.....	170

The figures above, if compared with the demand and activity data for all circular machines in Cleveland on pages 9 and 10, lead one to suspect that the failure of the trimming machines to measure up to the committee's specifications as to ideal size, cut, number of feeds, etc., did not make much difference in their practical utility to their users.

This question of trimmings, then, brings out an important point, namely that a manufacturer in rating his own machines must take carefully into consideration the particular nature of the work he expects a given machine to do. If that machine is likely to be needed for making the principal parts of garments subject to rapid style changes, presumably the only ideal machine for the purpose is one which would be rated 100 per cent by the Cleveland rating system.

DOES AGE TELL WHEN TO SCRAP A MACHINE?

Fortunately very accurate data are available on the ages of the circular machines in Cleveland. The serial numbers of practically all the serial machines were obtained and sent to the manufacturers of the machines, who from their records supplied the exact ages. The average age of these circular machines was 13 years and 3 months. There were relatively few recently purchased machines, the ages being grouped as follows:

Machines	Machines
Less than 1 year.....	19
1 to 3 years.....	35
4 to 7 years.....	179
8 to 12 years.....	450
13 to 20 years.....	448
21 to 38 years.....	195
Unknown.....	104
Total.....	1,430

Table I compares the extent to which the demand for the products of circular machines of different ages had kept up since the purchase of the machines. Only machines bought new by their present owners are included in this table, because the figures on decline in demand apply only to the period since the present owners purchased the machines, and in the case of second-hand machines obviously have no relation to the total age.

TABLE I.—CIRCULAR MACHINES OF VARYING AGES, BOUGHT NEW BY PRESENT OWNER, CLASSIFIED ACCORDING TO PER CENT PRODUCT STILL IN DEMAND

Product still in demand	Total number	Age in years						
		Less than 1	1-3	4-7	8-12	13-20	21-38	Unknown
0 per cent.....	18		1	8		6	3	
1 to 10 per cent.....	21			1	4	12	3	1
11 to 20 per cent.....	87			6	13	33	4	31
21 to 30 per cent.....	137			2	39	76	9	11
31 to 40 per cent.....	18			3	13	2		
50 per cent.....	347	5	3	52	88	115	72	12
60 per cent.....	6		1		5			
75 per cent.....	64			7	28	10	18	1
85 per cent.....	2			2				
100 per cent.....	344	13	24	47	89	116	45	10
150 per cent.....	11		4	3	2	2		
200 per cent.....	8			8				
Unknown.....	1	1						
Total.....	1,064	19	33	139	281	372	154	66

Table I indicates that the demand for the products of old machines often is, but is not necessarily, smaller than for the products of newer machines. As one would expect, the products of the machines less than 4 years old had, on the average, decreased much less in demand than the products of the machines 4 years old and older. But, on the other hand, the large proportion of relatively old machines whose products had not fallen off in demand since the machines were installed is striking. Thus, the demand for the products of 45 machines aged 21 to 38 years—nearly a third of the total machines of that age bought new by their present owners—had not decreased at all since their purchase.

Table J indicates conclusions somewhat similar to those of Table I. That is, the newer a machine, the more active it tended to be, but the exceptions are so important as to lead one to be wary in assuming that a very old machine will be so inefficient as to remain idle a large part of the time. Thus, of the 1,093 machines 8 to 38 years old, 30 per cent operated 71 per cent of the time or better. Of the 448 machines 13 to 20 years old, one-fourth operated 71 per cent of the time or better.

TABLE J.—CIRCULAR MACHINES OF VARYING AGES, CLASSIFIED ACCORDING TO PER CENT OF NORMAL WORKING TIME USED, 1929

Time operated	Total number	Age in years						
		Less than 1	1-3	4-7	8-12	13-20	21-38	Unknown
0 per cent.....	124		2	4	18	39	20	41
1 to 10 per cent.....	35		1	10	4	16	4	
11 to 20 per cent.....	94			7	26	51	9	1
21 to 30 per cent.....	155		3	3	55	66	7	21
31 to 40 per cent.....	183	1		26	55	46	46	9
41 to 50 per cent.....	224	13		25	71	67	45	3
51 to 60 per cent.....	56	3	2	4	23	10	11	3
61 to 70 per cent.....	94			19	17	42	19	6
71 to 80 per cent.....	209		4	50	113	73	17	12
81 to 90 per cent.....	60			12	6	10	24	8
91 to 100 per cent.....	82	2	16	15	36	13		
120 per cent.....	35		4	4	13	12	2	
Purchased since 1929.....	19		3		13	3		
Total.....	1,430	19	35	179	450	448	195	104

Finally, Table K provides the most direct testimony to answer the question of whether or not the degree of newness of a machine is an infallible measure of its effectiveness. This table, which classifies ratings by ages, is a particularly interesting one, since, as stated before, the ratings were computed without reference to the ages, and the table thus shows clearly the extent, if any, to which old machines are as effective as new machines. Undoubtedly, there is a general tendency in the table for the ratings to be higher for the newer machines, but the exceptions are striking. For instance, one notices immediately that although the 18 machines less than a year old average the highest in ratings of any age group, not one of them was rated over 90 per cent. Of the 37 machines rated above 90 per cent, 11 were 1 to 3 years old, 8 were 4 to 7 years old, 9 were 8 to 12 years old, and 3 machines rated at 100 per cent were 21 to 38 years old.

TABLE K.—CIRCULAR MACHINES WITH DIFFERENT RATINGS, CLASSIFIED ACCORDING TO AGE

Rating	Total number	Age in years						Unknown
		Less than 1	1-3	4-7	8-12	13-20	21-38	
0 per cent.	5					1	3	1
1 to 10	64				11	21	10	22
11 to 20 per cent.	32			4	15	12	1	
21 to 30 per cent.	82		1	15	27	26	11	2
31 to 40 per cent.	123			5	28	59	24	7
41 to 50 per cent.	410		1	36	145	166	14	48
51 to 60 per cent.	483	1	3	65	146	148	106	14
61 to 70 per cent.	31		9	1	16	5		
71 to 80 per cent.	93		2	19	37	10	18	2
81 to 90 per cent.	69	12	8	26	16		6	1
91 to 99 per cent.	16		7	7	2			
100 per cent.	21		4	1	7		3	6
Unknown	1							1
Total	1,430	18	35	179	450	448	196	104

In this connection it is interesting to note the great variation in ages of the machines that make up single batteries in knitting plants, that is, which are practically the same except in such features as diameter or cut in cases where a variety of diameter or cut is desired in a single battery. In many batteries, machines serving exactly the same purpose were found to vary from 6 to 25 years in age. Also, in many plants it was stated that the main parts of the machines practically never wear out. In one plant, for instance, there was a battery of machines, including three separate makes, which varied from 17 to 33 years in age and were said to be as good as new. It was stated that the only part subject to wear was the cylinder, which could easily be renewed, and that the maximum cost of repair at any time on these machines was \$15. One must not, therefore, assume that mere age brings about the obsolescence or unfitness of a machine to produce profitably.

But the general tendency for efficiency to decrease with age, is brought out by all three tables. Between an old machine and a new machine superficially identical there may be important differences in effectiveness not at first obvious. In any case, the older machines, are, of course, more likely to show the adverse effects of wear and tear, that is, of physical depreciation as distinct from obsolescence.

CLEVELAND'S MACHINE INVENTORY COMPARED WITH PHILADELPHIA'S

This section gives statistics for the convenience of anyone who desires to make a detailed study of Cleveland's machine inventory compared with Philadelphia's, or who wants to compare his own plant equipment with the general layout in either city.

Number and main classes of machines.—In the 32 plants covered by the Philadelphia survey there were 1,153 circular machines, 437 flat machines, and 14 Raschel machines, while in 15 plants covered by the Cleveland survey there were 1,430 circular machines, 353 flat machines, 266 Raschel machines, and 15 Kettenstuhl machines. The outstanding contrast in the process of knitting outerwear between Philadelphia and Cleveland would thus appear to be Cleveland's large reliance on the use of Raschel machines for knitting the cloth for sweaters, while the use of Raschel machines in Philadelphia is of no importance. To a certain extent this is probably due to a fundamental difference in type of product between the two cities. Philadelphia makes primarily novelties in knitted outerwear, while Cleveland makes primarily staples. Philadelphia has a large bathing-suit production and Cleveland has practically none.

Makes.—Table L, which shows makes of the Philadelphia and Cleveland machines by code letters, gives some idea of the extent to which the knitting machines used are concentrated among a few makes. The outstanding difference between Cleveland and Philadelphia is that in the circular machines make D is the second most important make used, while in Philadelphia there are no machines of make D in the plants surveyed.

TABLE L.—MAKES OF PHILADELPHIA AND CLEVELAND MACHINES¹

Circular			Flat			Raschel			Kettenstuhl		
Make	Philadelphia	Cleveland	Make	Philadelphia	Cleveland	Make	Philadelphia	Cleveland	Make	Philadelphia	Cleveland
A	111	450	A	202	167	A	0	110	A	0	8
B	241	133	B	69	106	B	0	34	B	0	4
C	206	330	Other	74	76	C	0	78	Other	0	3
D	0	419	Unknown	92	4	D	4	17			
E	880	47				Other	0	26			
Other	190	50				Unknown	10	1			
Unknown	25	1									
Total	1,153	1,430		437	353		14	266		0	15

¹ The code letters used in this table do not correspond with the code letters for makes used in the Philadelphia report.

² Except in this table, the Raschel machines in Philadelphia have been classed in this report as flat machines.

From this point on, wherever the flat machines in Philadelphia are referred to, they will include the 14 Raschel machines which in the Philadelphia survey, for convenience sake, were tabulated as flat machines.

Age.—The only thoroughly accurate data on ages of machines in the two surveys concern the ages of the circular machines in Cleveland, which have already been discussed. The ages of the other classes of machines in Cleveland and of the machines in Philadelphia are not in any way comparable in accuracy with the ages for the Cleveland circular machines, and hence are not presented here in tabular form. The data available on the ages of Raschel machines were particularly scanty and unsatisfactory, but the probability is that the Raschel machines in Cleveland average older than the circular machines and at least as old as the flat machines. It would be misleading, on account of the limited data, to make comparisons between the ages of the Cleveland and the Philadelphia machines.

Idleness.—Table M shows the per cent of normal working time operated by Philadelphia and Cleveland machines in recent periods. The figures for Philadelphia cover the last six months of 1928 and the figures for Cleveland the whole of 1929. For various reasons, it is impossible to use the same classification of per cent of time operated for both cities. In certain later tables in this section also it has been necessary to use different classifications for the same kind of information in the two cities. Of course, in comparing these figures, it must always be remembered that they relate to different periods. On the whole the circular machines were active a greater per cent of the time in Philadelphia than in Cleveland, though the reverse was true in the case of the flat machines. As regards the comparison of the different classes of machines in Cleveland, it may be said that the flat machines were more active than the circular machines and that the Raschel machines averaged the greatest activity of all.

TABLE M.—PER CENT OF NORMAL WORKING TIME OPERATED BY PHILADELPHIA AND CLEVELAND MACHINES IN RECENT PERIODS

Philadelphia			Cleveland					
Time in use, July-December, 1928	Circular	Flat	Time in use, 1929	Circular	Flat	Raschel	Kettenstuhl	
0 per cent.....	49	13	0 per cent.....	124	37	6	7	
5 per cent.....	3	2	1 to 10 per cent.....	35	10			
10 per cent.....	8	3	11 to 20 per cent.....	94	11			
20 per cent.....	5		21 to 30 per cent.....	155	19	1		
25 per cent.....	41	19	31 to 40 per cent.....	183	27	15		
33 1/3 per cent.....	2		41 to 50 per cent.....	224	34	14		
40 per cent.....	3		51 to 60 per cent.....	56	18	73		
50 per cent.....	307	75	61 to 70 per cent.....	94	18			
60 per cent.....		5	71 to 80 per cent.....	269	89	53		
75 per cent.....	92	54	81 to 90 per cent.....	60	5	46	8	
80 per cent.....	65	8	91 to 100 per cent.....	82	53	58		
90 per cent.....	4	12	120 per cent.....	35				
95 per cent.....	2	13	Purchased since 1929.....	19				
100 per cent.....	217	66	Unknown.....		32			
125 per cent.....	9							
150 per cent.....								
Unknown.....	348	166						
Total.....	1,153	451		1,430	353	266	15	

Sizes.—Table N shows a huge variety in the sizes of the circular and flat machines in both cities. There are 55 different known diameters of circular machines in Cleveland. About one-fourth of these are of 6 or 7 inch diameter. This contrasts with Philadelphia, which has very few 6 and 7 inch circular machines and which in general has less concentration in any two sizes. The outstanding width of flat machine used in Cleveland is 24 inches.

Originally, the purpose of the manufacturers in equipping their plants with so many sizes was, by producing the exact dimensions of cloth required, to economize on material. This, however, involved the use of more space and more idleness on the machines and often more labor per unit of product than if fewer machines had been purchased. At the present time the tendency is to manipulate the machines in such a manner as to obtain various widths of cloth from a single machine without wasting material. For instance, a 30-inch machine may be used not only to make a strip of cloth 30 inches wide, but to make two strips 15 inches wide or three 10 inches wide. The industry regards the extension of this practice as a possible fertile opportunity for simplification and for reducing costs.

TABLE N.—SIZES OF PHILADELPHIA AND CLEVELAND MACHINES

CIRCULAR—PHILADELPHIA					
Diameter in inches	Number of machines	Diameter in inches	Number of machines	Diameter in inches	Number of machines
Up to 1.....	21	11 1/4 to 12.....	42	23.....	16
1 1/4 to 2.....	47	13.....	27	24.....	13
2 1/4 to 3.....	98	14.....	62	26.....	2
3 1/4 to 4.....	52	15.....	38	28.....	21
4 1/4 to 5.....	56	16.....	96	30.....	81
5 1/4 to 6.....	22	17.....	37	32.....	1
6 1/4 to 7.....	10	18.....	86	36.....	2
7 1/4 to 8.....	10	19.....	58	Unknown.....	49
8 1/4 to 9.....	14	20.....	68		
9 1/4 to 10.....	31	21.....	47	Total.....	1,153
10 1/4 to 11.....	16	22.....	30		

CIRCULAR—CLEVELAND					
1 1/4.....	3	5 1/4.....	5	13.....	51
1 3/4.....	2	5 3/4.....	11	13 1/4.....	1
2.....	1	6.....	2	14.....	50
2 1/4.....	1	6 1/4.....	118	15.....	36
2 1/2.....	2	6 1/2.....	1	16.....	66
2 3/4.....	2	6 to 7.....	31	17.....	37
3.....	2	7.....	195	18.....	86
3 1/4.....	17	7 1/2.....	13	19.....	24
3 1/2.....	10	8.....	22	20.....	91
3 3/4.....	6	8 1/4.....	26	21.....	13
4.....	3	8 1/2.....	3	22.....	34
4 1/4.....	12	9.....	34	23.....	1
4 1/2.....	8	9 1/4.....	12	24.....	15
4 3/4.....	40	9 1/2.....	28	26.....	12
5.....	11	10.....	25	30.....	25
5 1/4.....	16	10 1/2.....	21	35.....	18
5 1/2.....	7	11.....	28	Unknown.....	5
5 3/4.....	22	11 1/4.....	34		
6.....	5	12.....	68	Total.....	1,430
6 1/4.....	12	12 1/4.....	3		

TABLE N.—SIZES OF PHILADELPHIA AND CLEVELAND MACHINES—Continued
FLAT—PHILADELPHIA AND CLEVELAND

Width in inches	Number of machines		Width in inches	Number of machines		Width in inches	Number of machines	
	Phila- delphia	Cleve- land		Phila- delphia	Cleve- land		Phila- delphia	Cleve- land
23.....	1	2	2 to 5.....	3		40.....	7	4
24.....	27	66	5.....		22	43.....		1
25.....	2	1	5½.....		1	43¾.....		2
26.....	18	7	6.....	2		44.....	5	13
27.....	1	1	6½.....		8	45.....	4	
28.....	9	19	7.....	19	32	48.....	3	
30.....	4	10	7½.....		1	52.....	1	
31.....	2	2	8.....	20		60.....		10
32.....	43	24	8½.....	6	10	61.....		1
33.....	1	1	9.....	23	17	66.....		3
34.....	6	1	9½.....		1	72.....		
35.....		1	10.....	32	24	80.....	3	
36.....	12	20	10½.....		1	100.....	10	
37½.....	6		11.....	38	28	Unknown.....	121	7
38.....		1	11½.....		1	Total.....	451	353
39.....		2	12.....	20	7			

RASCHEL—CLEVELAND			KETTENSTUHL—CLEVELAND		
Width in inches		Number of machines	Width in inches		Number of machines
37½.....		1	120.....		7
45.....		2	124.....		8
60.....		15			
84.....		246			
90.....					
Total.....		266	Total.....		15

Secondhand purchase.—Table O shows that Cleveland has a considerable lead over Philadelphia in buying circular machines new. Practically three-fourths of the circular machines in Cleveland were bought new, but a much smaller proportion of the Cleveland flat and Raschel machines were bought new than of the circular machines. In fact, more than half of the Raschel machines were bought secondhand, and it is possible, on account of the large number of machines for which data are missing, that as many as two-thirds of the Cleveland Raschel machines were bought secondhand.

Rebuilding.—Table P shows that both in the circular and flat machines there has been a much greater proportion of rebuilding in Philadelphia than in Cleveland, probably due largely to the fact that Philadelphia, as stated above, engages to a greater degree in novelty production.

In the Philadelphia and Cleveland surveys it was found that the rebuilding of machines consisted principally of adding pattern wheels. To a certain extent, also, feeds and strippers were added. In the Cleveland survey the changing of the number of needles per inch in order to make a finer or coarser stitch was not counted as rebuilding, because of the frequency with which cylinders and dials are changed back and forth.

TABLE O.—NEW OR SECONDHAND PURCHASE OF PHILADELPHIA AND CLEVELAND MACHINES

Classification	Circular		Flat		Raschel	Ketten- stuhl
	Phila- delphia	Cleve- land	Phila- delphia	Cleve- land	Cleve- land	Cleve- land
Bought new.....	641	1,064	168	168	86	7
Bought secondhand.....	284	318	141	139	100	8
Unknown.....	228	48	142	46	80	
Total.....	1,153	1,430	451	353	266	15

TABLE P.—REBUILDING OF PHILADELPHIA AND CLEVELAND MACHINES

Classification	Circular		Flat		Raschel	Ketten- stuhl
	Phila- delphia	Cleve- land	Phila- delphia	Cleve- land	Cleve- land	Cleve- land
Rebuilt.....	201	189	54	22	48	
Not rebuilt.....	744	1,236	250	318	114	15
Unknown.....	208	5	147	13	104	
Total.....	1,153	1,430	451	353	266	15

Type (including pattern wheel) and stitch.—Table Q shows the types of the circular and flat machines in Philadelphia and Cleveland. The classification of types used for Philadelphia was different from that used for Cleveland. No distinction between rack and rib stitch was made in the Philadelphia survey. As a result, Table Q does not include a breakdown by nature of stitch for Philadelphia. It will be noted that Cleveland has far fewer true Jacquard machines, both circular and flat, than Philadelphia has. However, Cleveland has a considerably larger proportion of machines equipped with pattern wheels than has Philadelphia. Philadelphia has a much larger proportion of circular machines with a jersey stitch than has Cleveland (not shown in Table Q). Of 993 circular machines of known stitch, 683 had a rib stitch (including rack) and 310 had a jersey stitch.

TABLE Q.—TYPE AND STITCH OF PHILADELPHIA AND CLEVELAND CIRCULAR AND FLAT MACHINES

Type and stitch	Circular		Flat	
	Phila- delphia	Cleve- land	Phila- delphia	Cleve- land
Plain:				
Ribber.....		725		
Racker.....		337		
Jersey.....		91		
Total.....	817	1,153	285	350
Pattern wheel:				
Ribber.....		33		
Racker.....		83		
Jersey.....		149		
Total.....	178	265		
Jacquard.....	84	10	40	3
Unknown type.....	74	12	126	3
Grand total.....	1,153	1,430	451	353

Needles per inch.—Table R shows the number of needles per inch on the Philadelphia and Cleveland circular and flat machines. In the circular machines the main contrast between the two cities is Cleveland's concentration in the range from 4 to 6 needles per inch, while Philadelphia's concentration is from 7 to 10.7 needles per inch. This difference again is probably due largely to Philadelphia's specializing in novelty and in bathing-suit production. Among the flat machines Philadelphia has a much greater percentage of machines of 2½ needles per inch than has Cleveland, the percentages being 40 and a little less than 25, respectively. Cleveland has a considerable concentration of flat machines in the range of 5 to 8 needles each. In Cleveland, out of 266 Raschel machines, 149 are 18 gage and 81 are 24 gage. The rest vary from 6 to 28 gage. All the Kettenstuhl machines now in operation in Cleveland have 12 needles per inch.

TABLE R.—NEEDLES PER INCH OF PHILADELPHIA AND CLEVELAND CIRCULAR AND FLAT MACHINES

Circular				Flat			
Philadelphia		Cleveland		Needles per inch		Machines	
Needles per inch	Machines	Needles per inch	Machines		Philadel- phia	Cleve- land	
2.5 to 2.9.....	63	1.....	1	2½.....	134	83	
3 to 3.7.....	26	2.....	2	3.....	31	5	
5.1 to 5.7.....	20	2½.....	9	4.....	2	8	
6 to 6.9.....	30	3.....	45	4½.....	15	78	
7 to 7.8.....	198	3½.....	1	5.....	9	52	
7 or 8.....	70	4.....	187	5½.....	13	1	
8 to 8.5.....	252	4½.....	83	6.....	52	63	
9 to 9.3.....	43	5.....	237	6 or 8.....	29	48	
10 to 10.7.....	113	5½.....	46	6½.....	1	1	
11 to 11.5.....	9	6.....	254	7.....	1	7	
12.....	90	6½.....	14	8.....	1	1	
13 to 15.....	24	7.....	157	9.....	14	7	
16 to 18.....	37	7½.....	61	10.....	1	1	
Unknown.....	178	8.....	114	11.....	1	1	
		9.....	58	12.....	1	1	
		10.....	47	13.....	1	1	
		11.....	50	14.....	1	1	
		12.....	2	15.....	1	1	
		13.....	29	16.....	1	1	
		13½.....	7	Unknown.....	118	1	
		14.....	8				
		15.....	10				
		16.....	10				
Total.....	1,153		1,430	Total.....	451	353	

Feeds.—Table S shows the number of feeds on the Philadelphia and Cleveland machines. The Cleveland circular machines have considerably fewer feeds on the average than the Philadelphia circular machines. Out of the 1,430 circular machines in Cleveland, 813 have only two feeds apiece. Philadelphia has a much larger proportion of machines with 6 and 8 feeds.

Striper changes.—Table T shows the striper changes on the Philadelphia and Cleveland machines. Cleveland has a greater proportion than Philadelphia of circular machines with 1, 2, and 3 striper changes, but Philadelphia has a much greater proportion of machines with 4 striper changes than Cleveland. About two-fifths of the flat machines in both cities have no striper changes. (In the Philadelphia report striper changes on flat machines were called yarn changes, but the two terms mean the same.)

TABLE S.—FEEDS OF PHILADELPHIA AND CLEVELAND CIRCULAR MACHINES

Number of feeds	Number of machines		Number of feeds	Number of machines	
	Philadel- phia	Cleveland		Philadel- phia	Cleve- land
1.....	68	16	8.....	206	97
1 or 2.....	24	813	8 or 12.....	49	19
2.....	335	20	10.....	1	6
3.....	3	349	12.....	8	4
4.....	129	7	14.....	2	2
4 or 6.....	4	3	16.....	84	1,430
4 or 8.....	14	82	Unknown.....		
5.....	202		Total.....	1,153	1,430
6 or 8.....	24				

Needle.—In Cleveland 97 per cent of the circular machines have latch needles, compared with only 92 per cent of the machines in Philadelphia. The number of machines were as follows: Latch-needle machines, Philadelphia 999, Cleveland 1,391; spring-needle machines, Philadelphia 84, Cleveland 38.

Lock.—No figures on the nature of the lock were gathered for Philadelphia. In Cleveland 292 flat machines are single lock, 60 double lock, and 1 triple lock.

Operation.—A larger proportion of the Cleveland flat machines are semiautomatic than of the Philadelphia flat machines, and a smaller percentage are hand machines. More than 60 per cent (216) of the Cleveland flat machines are semiautomatic and about 12 per cent (42) are hand operated. Cleveland has 82 full-automatic flat machines. The per cent of full-automatic machines is about the same for the two cities. In Cleveland 12 flat machines were reported merely as "power" machines. In Cleveland there are 53 automatic Raschel machines compared with 213 plain machines. All Raschel machines are run by power.

TABLE T.—STRIPER CHANGES OF PHILADELPHIA AND CLEVELAND CIRCULAR AND FLAT MACHINES

Circular			Flat		
Number of striper changes	Number of machines		Number of striper changes	Number of machines	
	Philadel- phia	Cleve- land		Philadel- phia	Cleve- land
None.....	589	576	None.....	112	148
1.....	36	438	1.....	30	83
2.....	160	290	2.....	58	55
2 or 3.....	15	12	2 or 3.....	52	35
2 or 4.....	16	110	3.....	25	1
3.....	55	8	4.....	8	20
4.....	107		5.....	166	
5.....	12		Unknown.....		
6.....	6				
7.....		7			
8.....	49	1			
9.....	2				
10.....	2				
Unknown.....	106				
Total.....	1,153	1,430	Total.....	451	353

Products.—Table U shows the products of the circular and flat machines in Cleveland and Philadelphia. The main difference between Philadelphia and Cleveland in the kind of products is the small amount of bathing-suit production in Cleveland as compared with Philadelphia. This is probably due largely to the more recent establishment of the knitting business in Philadelphia. Cleveland's knitting industry was established to a considerable extent before the modern bathing suit came into vogue. It should also be noted that in Cleveland the flat machines are used almost exclusively for making trimmings, while Philadelphia has a fairly important production of shaker sweaters on its flat machines. The Raschel machines in Cleveland are used almost exclusively to produce sweaters, as are also those Kettenstuhl machines which are still running.

TABLE U.—PRODUCTS OF PHILADELPHIA AND CLEVELAND CIRCULAR AND FLAT MACHINES

CIRCULAR MACHINES			
PHILADELPHIA		CLEVELAND	
Products	Machines	Products	Machines
Bathing suits.....	49	Sweaters.....	441
Bathing suits, trimmings.....	6	Caps and scarfs.....	131
Boys' suits, sport coats.....	8	Hockey caps.....	147
Cloth.....	80	Gloves and sweaters.....	26
Golf hose.....	1	Sweaters and trimmings.....	264
Women's wear.....	2	Trimmings.....	170
Men's scarfs.....	4	Sweaters and bathing suits.....	20
Ribbed children's wear.....	12	Sweaters, jackets, and caps.....	23
Shaker sweaters.....	34	Sleeves.....	92
Sport coats, sweaters.....	8	Ladies' suits and sweaters.....	9
Sport coats, sweaters, bathing suits.....	10	Astrakhan sweaters.....	24
Sweaters.....	279	Hockey caps and sleeves.....	20
Sweaters, bathing suits.....	262	Sport coats.....	9
Sweaters, cloth.....	58	Bathing suits and sport coats.....	6
Sweaters, hose.....	12	Mittens.....	30
Sweaters, women's suits.....	253	Miscellaneous.....	18
Trimmings.....	73		
Unknown.....			
Total.....	1,153	Total.....	1,430

FLAT MACHINES			
Trimmings.....	89	Trimmings.....	212
Shaker sweaters.....	120	Sweaters.....	120
Shaker sweaters, trimmings.....	16	Caps.....	12
Sweaters, women's suits.....	2	Sleeves.....	5
Sweaters, hose.....	14	Sweaters and caps.....	4
Sweaters.....	63		
Sweaters, trimmings.....	14		
Sweaters, bathing suits.....	10		
Sport coats.....	1		
Women's wear.....	13		
Unknown.....	109		
Total.....	451	Total.....	353

APPENDIX

This appendix contains the tables on demand trends and activity of the Cleveland circular machines which were used in analyzing the committee's ratings and also somewhat similar tables for the Cleveland flat machines, except that the information for the flat machines is not broken down by types. These tables should be useful to anyone who desires to study in detail the relation of various individual features of construction of machines, such as size, needles per inch, feeds, and striper changes, to the trend in the demand for the products of the machines, and to the per cent of normal working time which they operated in 1929.

TABLE I.—CIRCULAR RIBBER MACHINES CLASSIFIED ACCORDING TO PER CENT PRODUCT STILL IN DEMAND

Diameter in inches	Number	Per cent product still in demand												Unknown
		0	1-10	11-20	21-30	31-40	50	60	65	75	100	150		
1 1/2	1													
1 3/4	1													
2	1													
2 1/4	1													
2 1/2	1													
2 3/4	16											15		1
3	6											4		2
3 1/4	2											2		
3 1/2	2	1			1									
3 3/4	11		1		2							8		
4	8				1		3					4		
4 1/4	28				1		13					14		
4 1/2	6				2							4		
4 3/4	8						1					7		
5	7						2					5		
5 1/4	6				3							3		
5 1/2	1													
5 3/4	1													
6	100	3	2	11	50		19					15		
6 1/4	1						1							
6 1/2	30			30										
6 3/4	129		3	23	57		22					23		1
7	1													
7 1/4	10				1		7					1		1
7 1/2	3						1					1		
7 3/4	8						3					3		1
8	2					1								
8 1/4	18			4								1		
8 1/2	2					2	8					2		1
8 3/4	10 1/2											1		
9	21		1	4		2	8					2		3
9 1/4	4											3		
9 1/2	30		3	4		2	9	1	1	3	6			1
10	26		2	3		2	11		2	2	3			1
10 1/4	14		2	1		2	15		1	1	3			
10 1/2	19		2	1		2	7	1	1	1	4			
11	33		2	1		2	8	1	1	4	14			
11 1/4	17		1	1	1	1	8	1	2		1			1
11 1/2	26													
11 3/4	2													
12	26		1		2		12	1		9	1			
12 1/4	12						8				4			
12 1/2	2						1				1			
12 3/4	5						3				1			
13	758	14	27	83	132	18	208	9	12	39	188	5		23

TABLE 2.—CIRCULAR RIBBER MACHINES CLASSIFIED ACCORDING TO PER CENT OF NORMAL WORKING TIME USED, 1929

Diameter In inches	Number	Per cent of time used											Pur- chased since 1929
		0	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	
1 1/4	1				1								
1 1/2	1									1			
1 3/4	1											1	
1 3/4	1						1						
1 3/4	16	1			1		3			10		1	
2	6	2					2			2			
2 1/4	2									2			
2 1/2	2	1			1								
3	11	1			2						7	1	
3 1/4	8				1		3				4		
3 1/2	28				1		13			1	13		
3 3/4	6				2		1				3		
4	8	1	2			1				2	2		
4 1/4	7				3		2				1		
4 1/2	6	1			2		2			1			
4 3/4	1								1				
5	7					2	4			1			
5 1/4	5				2	3							
5 1/2	8	1			2	3	1			1			
5 3/4	2	1			1		1						
6	100	13		12	42	1	8						
6 1/4	1												
6 1/2	30	30											
6-7	129	12		38	35	1	7			35			1
7	1						1						
7 1/2	10				1	5	3			1			
8	3						2						
8 1/4	8	1		1		1	2			3			
9	1						1						
9 1/4	1						1			1			
9 3/4	2								1				
10	18	1		5		2	6	1		3			
10 1/2	2						2						
11	21	1		7		1	8			4			
11 1/4	4						3						
12	30	1		5		3	13	1	2	3		2	
13	26	1		4		5	13			3			
14	25	1		2		11	8		1	2			
15	19	1		2		3	2		1	3			
16	33	9		2		2	12		2	2			
17	17		2	2		3	9	1					
18	26	4		2		7	6	1	2			4	
19	10					1	7					2	
20	68	9	13	7	4	9	13	4	4	1	1	3	
21	2						1						
22	26		2	1		8	6	7	2				
24	12						3	2	6			1	
26	2						1					1	
30	5							3	1			1	
Total.....	758	94	19	90	100	76	174	22	26	104	31	21	1

TABLE 3.—CIRCULAR RACKER MACHINES CLASSIFIED ACCORDING TO PER CENT PRODUCT STILL IN DEMAND

Diameter in inches	Number	Per cent product still in demand					
		1-10	21-30	50	75	100	Unknown
1	1			1			
3	6			6			
3	4			4			
4	6			6			
4	14			14			
4	4			4			
5	2			2			
5	3			3			
6	13	1				12	
6	1			1			
7	54		1	1		52	
7	12			4	2	6	
8	22			4	1	16	1
8	3			1		2	
9	24			4	5	15	
9	11			2		9	
9	26			4	4	17	1
10	7			6		1	
10	22			2		17	3
11	7			7			
11	30			8		20	2
12	36			15	1	19	1
12	3					3	
13	23			14		9	
13	1						1
14	21			14		7	
15	14			4		8	2
16	13			4		8	1
17	9			3		6	
18	3			2			1
19	3			1		2	
20	17			15		2	
21	4			4			
Unknown	1					1	
Total	420	1	1	160	13	232	13

TABLE 4.—CIRCULAR RACKER MACHINES CLASSIFIED ACCORDING TO PER CENT OF NORMAL WORKING TIME USED, 1929

Diameter in inches	Number	Per cent of time used									Purchased since 1929
		0	21-30	31-40	41-50	51-60	61-70	71-80	91-100	120	
1	1							1			
3½	6			6							
3¾	4			4							
4	6			6							
4½	14			13				1			
4¾	4			4							
5	2			2							
5½	3			3							
6	13	2					11				
6-7	1			1							
7	54	1	1				50	2			
7½	12			1				9	1	1	
7¾	22	2		1		1		10	2	5	1
8¼	3	1		1				1			
8¾	24			2	2			7	6	6	1
9											
9¼	11			1	6			4			
9¾	26			1	5	1		10	4	4	1
10	7			6	1			1			
10½	22			1	2	3		14	1	1	1
11	7			7							

TABLE 4.—CIRCULAR RACKER MACHINES CLASSIFIED ACCORDING TO PER CENT OF NORMAL WORKING TIME USED, 1929—Continued

Diameter in inches	Number	Per cent of time used									Purchased since 1929
		0	21-30	31-40	41-50	51-60	61-70	71-80	91-100	120	
11¼	30				1	2	1	22		2	2
12	36			5	2	1		20	2	1	6
12½	3										1
13	23			5	1	1		15	1		
13½	1					1					
14	21			6	1	1		9	4		
15	14			2	1	2		5	2		2
16	13			2	1	2		4	1	2	1
17	9			2	3			3	1		
18	3			1		1		1			
19	3							1	1		1
20	17				11			4			2
21	4			1				3			
Unknown	1				1						
Total	420	6	1	83	38	16	62	147	26	23	18

TABLE 5.—CIRCULAR JERSEY MACHINES CLASSIFIED ACCORDING TO PER CENT PRODUCT STILL IN DEMAND

Diameter in inches	Number	Per cent product still in demand											Unknown
		0	1-10	11-20	21-30	50	60	75	85	100	150	200	
1 1/4	2		1							1			
1 1/2	1					1							
1 3/4	1									1			
1 1/2	1		1										
1 3/4	1		1										
1 1/4	1												
1 1/2	2		1	1						1			
1 3/4	1												
2	4		1	1		2							
2 1/4	4												
2 1/2	1			1		4							
3	1									1			
3 1/4	6		2							4			
3 1/2	1									1			
4	2		1							1			
4 1/2	2			1						1			
5	3	1								1			1
6	4	3	1										
7	11				9					2			
8	12	7				1				4			
8 1/4	1												1
9	2									2			1
12	1												
13	2												3
14	4									1			2
15	3								1				
16	15								1	12			2
17	11								1	7			3
18	37					6			27	14	8		1
19	11		1			1		2	5				
20	6		1						1		1		2
21	7	1							1				
22	8					2				5			1
23	1					1							
24	3									3			
26	10					2				8			
30	20						8			12			
35	18								12	6			
Total	240	12	12	4	9	16	8	24	2	110	15	8	20

TABLE 6.—CIRCULAR JERSEY MACHINES CLASSIFIED ACCORDING TO PER CENT OF NORMAL WORKING TIME USED, 1929

Diameter in inches	Number	Per cent of time used											
		0	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	120
1 1/4	2	1	1										
1 1/2	1	1											
1 3/4	1	1				1							
1 1/4	1	1											
1 1/2	2	1		1									
1 3/4	1		1										
1 1/2	4		1	1			2						
2 1/4	4												
2 1/2	1			1		4							
3	1												
3 1/4	6	2	4			1							
3 1/2	1					1							
4	2	1	1										
4 1/2	2		1	1									
5	3	2	1										
6	4	4	1										
7	11					11							
8	12	7				4		1					
8 1/4	1					1							
9	2		1			1							
12	1		1										
13	2		1										
14	4					3							
15	3					2							
16	15		1										
17	11		1					5			1	2	5
18	57	1				5					1	6	
19	11					4		1	1	11	6	14	8
20	6												12
21	7					2	1	1			2		
22	8						1			2		2	
23	1							2			5		
24	3							1					
26	10					1	4	2		1		1	
30	20												
35	18					8	6	1		2		3	
Total	240	22	15	4	54	24	11	18	6	18	29	27	12

TABLE 7.—CIRCULAR RIBBER MACHINES CLASSIFIED ACCORDING TO PER CENT PRODUCT STILL IN DEMAND

Needles per inch	Number	Per cent product still in demand												
		0	1-10	11-20	21-30	31-40	50	60	65	75	100	150	Un- known	
2	1	1												
2 1/4	5				5									
3	13				4									
4	164		1	53	17		4				1		4	
4 1/2	6						72				20		1	
							6							
5	130		1	26	36	17	32				16	2		
5 1/4	35										6			
6	146	9	10		14		13		12	16				
6 1/2	7	1	4								100			
													2	
7	111	1	1	4	27	1	42	3		1	18	3	10	
8	37	1	10				10			3	8		4	
9	70				19		17	6		18	9		1	
10	26	1			5		10			1	9			
11	2													
12	2													
14	1						1						1	
16	2						2							
Total	758	14	27	83	132	18	208	9	12	39	188	5	23	

TABLE 8.—CIRCULAR RIBBER MACHINES CLASSIFIED ACCORDING TO PER CENT OF NORMAL WORKING TIME USED, 1929

Needles per inch	Number	Per cent of time used											Purchased since 1929
		0	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	
2	1	1											
2½	5				5								
3	13	6		4	1								
3½	164	39		27	5	38	43			12			
4	6				6								
4½													
5	130	9		28	31		20			38		4	
5½	35				1	28			6				
6	146	27	11	15		13			4	39	31	5	1
6½	7	1	2	4									
7	111	6		9	31	9	41	3	9			3	
7½	37	4		3	4	1	13	2	3	5		6	
8	70				19	11	10	17	4			1	
9	26	1	2		2	9	5			6			
10													
11	2				1	1							
12	2		1										
14	1		1										
16	2		2										
Total	758	94	19	90	100	76	174	22	26	104	31	21	1

TABLE 9.—CIRCULAR RACKER MACHINES CLASSIFIED ACCORDING TO PER CENT PRODUCT STILL IN DEMAND

Needles per inch	Number	Per cent product still in demand					Unknown
		1-10	21-30	50	75	100	
3	22			3		19	
4	22		1			21	
4½	77			74		3	
5	92			33		59	
5½	11				11		
6	99			11		75	13
6½	7					7	
7	36	1		26		9	
7½	8					8	
8	11			8		3	
9	28			1	2	25	
10	7			4		3	
Total	420	1	1	160	13	232	13

TABLE 10.—CIRCULAR RACKER MACHINES CLASSIFIED ACCORDING TO PER CENT NORMAL WORKING TIME USED, 1929

Needles per inch	Number	Per cent of time used										Purchased since 1929
		0	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	120	
3	22			3			19					
4	22	2	1		7		12					
4½	77			74			3					8
5	92						23	43		18		
5½	11							11	5			
6	99				25	13	8	43		5		
6½	7						7					
7	36	1		5	6			24				7
7½	8						1					
8	11			1		3		7				
9	28	3					19	6				8
10	7							4				
Total	420	6	1	83	38	16	62	147	26	23		18

TABLE 11.—CIRCULAR JERSEY MACHINES CLASSIFIED ACCORDING TO PER CENT PRODUCT STILL IN DEMAND

Needles per inch	Number	Per cent product still in demand														Unknown
		0	1-10	11-20	21-30	50	60	75	85	100	150	200				
1	1		1													
2	1					1										
2½	4		1			3										
3	9				9											
3½	1															1
4	1															
5	15	10	2													
6	8		1	3						3						
7	2		2							4						
8	12			1						11						
9	16															
10	26		3				6			10						
11	45					8				14						
12	48	1				4			2	9	15	8				
13	2		1				10			37						
13½	29									1						
14	6									10						19
15	6		1							5						
16	8															
Total	240	12	12	4	9	16	8	24	2	110	15	8				20

TABLE 12.—CIRCULAR JERSEY MACHINES CLASSIFIED ACCORDING TO PER CENT NORMAL WORKING TIME USED, 1929

Needles per inch	Number	Per cent of time used											
		0	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	120
1	1	1											
2	1	1											
2½	4	1					3						
3	9				9								
3½	1	1											
4	1												
5	15	12	3										
6	8	1	4	3									
7	2	1	1										
8	12		2	1	9								
9	16												
10	26	2			3	16	8						
11	45				6					1	10		
12	48	1				6				10	8	2	12
13	2		1							2	5	23	
13½	29									1			
14	6		4		19				6				
15	6									4		2	
16	8										6		
Total	240	22	15	4	54	24	11	18	6	18	29	27	12

TABLE 13.—CIRCULAR RIBBER MACHINES CLASSIFIED ACCORDING TO PER CENT PRODUCT STILL IN DEMAND

Feeds	Number	Per cent product still in demand												Un-known
		0	1-10	11-20	21-30	31-40	50	60	65	75	100	150		
1.....	8				1		6				1		3	
2.....	415	4	6	64	123	3	52			18	144		1	
3.....	2						1						14	
4.....	207	5	11	19	8	15	113			12	4	2	2	
5.....	2													
6.....	51	4					7	9		4	24	3	2	
8.....	53	1	10				26			11	3		1	
12.....	7										6			
14.....	6										6			
4 or 6.....	7						3			4				
Total.....	758	14	27	83	132	18	206	9	12	39	188	5	23	

TABLE 14.—CIRCULAR RIBBER MACHINES CLASSIFIED ACCORDING TO PER CENT OF NORMAL WORKING TIME USED, 1929

Feeds	Total number	Per cent of time used											Purchased since 1929
		0	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	
1.....	8	1	1							6			
2.....	415	63	1	50	96	15	66		10	78	30	5	1
3.....	2					1	1						
4.....	207	11	13	39	4	45	70	2		18	1	4	
5.....	2					2							
6.....	51	16	4			1	7	9	4	1		9	
8.....	53	2		1		11	19	11	6	1		2	
12.....	7	1				1	4					1	
14.....	6								6				
4 or 6.....	7						7						
Total.....	758	94	19	90	100	76	174	22	26	104	31	21	1

TABLE 15.—CIRCULAR RACKER MACHINES CLASSIFIED ACCORDING TO PER CENT PRODUCT STILL IN DEMAND

Feeds	Number	Per cent product still in demand					
		1-10	21-30	50	75	100	Un- known
2.....	352	1		104	13	223	11
3.....	10		1			9	2
4.....	58			56			
Total.....	420	1	1	160	13	232	13

TABLE 16.—CIRCULAR RACKER MACHINES CLASSIFIED ACCORDING TO PER CENT OF NORMAL WORKING TIME USED, 1929

Feeds	Number	Per cent of time used									Pur- chase since 1929
		0	21-30	31-40	41-50	51-60	61-70	71-80	91-100	120	
2.....	352	6		45	27	14	62	132	25	23	18
3.....	10		1					8			
4.....	58			38	11	2		7			
Total.....	420	6	1	83	38	16	62	147	26	23	18

TABLE 17.—CIRCULAR JERSEY MACHINES CLASSIFIED ACCORDING TO PER CENT PRODUCT STILL IN DEMAND

Feeds	Number	Per cent product still in demand											
		0	1-10	11-20	21-30	50	60	75	85	100	150	200	Unknown
1.....	8	1				3				3			1
2.....	46	3	9	4	9	5				16			
3.....	7	7											
4.....	79					1	8	4		53	9	4	
5.....	1									1			
6.....	27	1	2			2		10					12
8.....	44					5							
10.....	6							4		23	1	4	7
12.....	12		1					6					
16.....	6								2	5	4		
20.....	4									5	1		
Total.....	240	12	12	4	9	16	8	24	2	110	15	8	20

TABLE 18.—CIRCULAR JERSEY MACHINES CLASSIFIED ACCORDING TO PER CENT OF NORMAL WORKING TIME USED, 1929

Feeds	Number	Per cent of time used											
		0	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	120
1.....	8	3	2		1		2						
2.....	46	11	8	4	22		1						
3.....	7												
4.....	79		1		8	10	1	11	1	5	12	23	7
5.....	1	1											
6.....	27		4		8	4	2			9			
8.....	44				11	4	5	6	3		14	1	
10.....	6					4							
12.....	12									2	2	4	
16.....	6									2	1	2	1
20.....	4							1		2	1		
Total.....	240	22	15	4	54	24	11	18	6	18	29	27	12

TABLE 19.—CIRCULAR RIBBER MACHINES CLASSIFIED ACCORDING TO PER CENT PRODUCT STILL IN DEMAND

Striper changes	Total number	Per cent product still in demand											
		0	1-10	11-20	21-30	31-40	50	60	65	75	100	150	Un-known
0.....	417	10	22	19	28	1	182	9	-----	19	102	5	20
1.....	171	1	5	34	42	17	21			19	32		
2.....	161			30	62		4		12		51		2
3.....	7	3								1	3		
4.....	1						1						
7.....	1												1
Total.....	758	14	27	83	132	18	208	9	12	39	188	5	23

TABLE 20.—CIRCULAR RIBBER MACHINES CLASSIFIED ACCORDING TO PER CENT OF NORMAL WORKING TIME USED, 1929

Striper changes	Number	Per cent of time used											Purchased since 1929
		0	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	
0.....	417	38	12	39	26	63	121	19	12	53	22	12	-----
1.....	171	20	-----	34	31	12	39	3	14	7	9	2	-----
2.....	161	36	5	16	43	-----	13	-----	-----	43	-----	4	1
3.....	7	-----	2	1	-----	-----	1	-----	-----	-----	-----	-----	-----
4.....	1	-----	-----	-----	-----	1	-----	-----	-----	-----	-----	-----	-----
7.....	1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Total.....	758	94	19	90	100	76	174	22	26	104	31	21	1

TABLE 21.—CIRCULAR RACKER MACHINES CLASSIFIED ACCORDING TO PER CENT PRODUCT STILL IN DEMAND

Striper changes	Number	Per cent product still in demand					
		1-10	21-30	50	75	100	Unknown
0	68		1	59		8	
1	245	1		90	13	128	13
2	107			11		96	
Total	420	1	1	160	13	232	13

TABLE 22.—CIRCULAR RACKER MACHINES CLASSIFIED ACCORDING TO PER CENT OF NORMAL WORKING TIME USED, 1929

Striper changes	Number	Per cent of time used										Purchased since 1929
		0	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	120	
0.....	68	-----	1	52	-----	-----	-----	7	-----	-----	-----	8
1.....	245	6	-----	31	5	16	-----	132	25	23	-----	7
2.....	107	-----	-----	33	-----	-----	62	8	1	-----	-----	3
Total.....	420	6	1	83	38	16	62	147	26	23	-----	18

TABLE 23.—CIRCULAR JERSEY MACHINES CLASSIFIED ACCORDING TO PER CENT PRODUCT STILL IN DEMAND

Striper changes	Number	Per cent product still in demand											Unknown
		0	1-10	11-20	21-30	50	60	75	85	100	150	200	
0.....	91	3	10	3	-----	9	8	16	-----	39	2	-----	1
1.....	13	8	-----	1	-----	-----	-----	-----	-----	3	1	-----	-----
2.....	22	1	-----	9	-----	-----	-----	-----	63	12	-----	-----	15
3.....	100	-----	2	-----	-----	7	-----	-----	-----	4	-----	-----	-----
4.....	7	-----	-----	-----	-----	-----	-----	2	-----	1	-----	-----	-----
7.....	6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
9.....	1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Total.....	240	12	12	4	9	16	8	24	2	110	15	8	20

TABLE 24.—CIRCULAR JERSEY MACHINES CLASSIFIED ACCORDING TO PER CENT OF NORMAL WORKING TIME USED, 1929

Striper changes	Number	Per cent of time used												
		0	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	120	
0-----	91	14	10	3	14	22	4	4	3	4	11	2		
1-----	13	8		1	3					1				
2-----	22		4		9									
3-----	100		1		26	2		14	3	8	10	24	12	
4-----	7						7							
7-----	6				2					4				
9-----	1											1		
Total-----	240	22	15	4	54	24	11	18	6	18	29	27	12	

TABLE 25.—CIRCULAR PLAIN AND PATTERN-WHEEL MACHINES OF DIFFERENT TYPES, CLASSIFIED ACCORDING TO PER CENT PRODUCT STILL IN DEMAND

Product still in demand	Total number	Plain			Pattern wheel		
		Ribber	Racker	Jersey	Ribber	Racker	Jersey
0 per cent.....	26	14	-----	2	-----	-----	10
1 to 10 per cent.....	42	27	1	12	-----	-----	-----
11 to 20 per cent.....	87	83	-----	4	-----	-----	-----
21 to 30 per cent.....	142	132	1	9	-----	-----	-----
31 to 40 per cent.....	18	18	-----	-----	-----	-----	-----
50 per cent.....	384	190	134	15	18	26	1
60 per cent.....	17	9	-----	-----	-----	-----	8
65 per cent.....	12	12	-----	-----	-----	-----	-----
75 per cent.....	76	29	13	8	10	-----	16
85 per cent.....	2	-----	-----	-----	-----	-----	2
100 per cent.....	540	186	175	21	2	57	89
150 per cent.....	20	5	-----	-----	-----	-----	15
200 per cent.....	8	-----	-----	-----	-----	-----	8
Unknown.....	56	20	13	20	3	-----	-----
Total.....	1,430	725	337	91	33	83	149

TABLE 26.—CIRCULAR PLAIN AND PATTERN-WHEEL MACHINES OF DIFFERENT TYPES, CLASSIFIED ACCORDING TO PER CENT OF NORMAL WORKING TIME USED, 1929

Time operated	Total number	Plain			Pattern wheel		
		Ribber	Racker	Jersey	Ribber	Racker	Jersey
0 per cent.....	124	94	2	12	-----	4	10
1 to 10 per cent.....	35	18	-----	14	1	-----	1
11 to 20 per cent.....	94	89	-----	4	1	-----	-----
21 to 30 per cent.....	155	100	1	29	-----	-----	25
31 to 40 per cent.....	183	74	83	12	2	-----	12
41 to 50 per cent.....	224	173	21	10	1	17	1
51 to 60 per cent.....	56	7	13	-----	15	3	18
61 to 70 per cent.....	94	26	62	-----	-----	-----	6
71 to 80 per cent.....	269	93	108	9	11	39	9
81 to 90 per cent.....	60	31	-----	1	-----	-----	28
91 to 100 per cent.....	82	19	16	-----	2	10	27
120 per cent.....	35	-----	23	-----	-----	-----	12
Purchased since 1929.....	19	1	8	-----	-----	10	-----
Total.....	1,430	725	337	91	33	83	149

TABLE 27.—PLAIN AND JACQUARD FLAT MACHINES, CLASSIFIED ACCORDING TO PER CENT PRODUCT STILL IN DEMAND

Product still in demand	Total number	Plain	Jacquard
11 to 20 per cent.....	12	12	-----
21 to 30 per cent.....	22	22	-----
41 to 50 per cent.....	60	60	-----
61 to 70 per cent.....	1	1	-----
81 to 90 per cent.....	12	12	-----
91 to 100 per cent.....	220	217	3
Unknown.....	26	26	-----
Total.....	353	350	3

TABLE 28.—PLAIN AND JACQUARD FLAT MACHINES, CLASSIFIED ACCORDING TO PER CENT OF NORMAL WORKING TIME USED, 1929

Time operated	Total number	Plain	Jacquard
0 per cent.....	37	37	-----
1 to 10 per cent.....	10	10	-----
11 to 20 per cent.....	11	11	-----
21 to 30 per cent.....	19	19	-----
31 to 40 per cent.....	27	27	-----
41 to 50 per cent.....	34	34	-----
51 to 60 per cent.....	18	18	-----
61 to 70 per cent.....	18	18	-----
71 to 80 per cent.....	89	89	-----
81 to 90 per cent.....	5	5	-----
91 to 100 per cent.....	53	53	-----
Unknown.....	32	32	-----
Total.....	353	350	3

TABLE 29.—FLAT MACHINES WITH DIFFERENT TYPES OF LOCK, CLASSIFIED ACCORDING TO PER CENT PRODUCT STILL IN DEMAND

Product still in demand	Total number	Lock		
		Single	Double	Triple
11 to 20 per cent.....	12	5	7	-----
21 to 30 per cent.....	22	21	1	-----
41 to 50 per cent.....	60	59	1	-----
61 to 70 per cent.....	1	1	-----	-----
81 to 90 per cent.....	12	12	-----	-----
91 to 100 per cent.....	220	171	48	1
Unknown.....	26	23	3	-----
Total.....	353	292	60	1

TABLE 30.—FLAT MACHINES WITH DIFFERENT TYPES OF LOCK, CLASSIFIED ACCORDING TO PER CENT OF NORMAL WORKING TIME USED, 1929

Time operated	Total number	Lock		
		Single	Double	Triple
0 per cent.....	37	24	13	-----
1 to 10 per cent.....	10	9	1	-----
11 to 20 per cent.....	11	8	3	-----
21 to 30 per cent.....	19	17	2	-----
31 to 40 per cent.....	27	26	1	-----
41 to 50 per cent.....	34	34	-----	-----
51 to 60 per cent.....	18	8	10	-----
61 to 70 per cent.....	18	18	-----	-----
71 to 80 per cent.....	89	68	20	1
81 to 90 per cent.....	5	5	-----	-----
91 to 100 per cent.....	53	43	10	-----
Unknown.....	32	32	-----	-----
Total.....	353	292	60	1

TABLE 31.—FLAT MACHINES OF DIFFERENT TYPES OF OPERATION, CLASSIFIED ACCORDING TO PER CENT PRODUCT STILL IN DEMAND

Product still in demand	Total number	Type of operation				
		Full auto-matic	Semi-auto-matic	Power	Hand	Un-known
11 to 20 per cent.....	12	-----	1	-----	-----	-----
21 to 30 per cent.....	22	-----	22	-----	11	-----
41 to 50 per cent.....	60	-----	52	-----	8	-----
61 to 70 per cent.....	1	1	-----	-----	-----	-----
81 to 90 per cent.....	12	12	-----	-----	-----	-----
91 to 100 per cent.....	220	62	126	11	21	-----
Unknown.....	26	7	15	1	2	1
Total.....	353	82	216	12	42	1

TABLE 32.—FLAT MACHINES OF DIFFERENT TYPES OF OPERATION CLASSIFIED ACCORDING TO PER CENT OF NORMAL WORKING TIME USED, 1929

Time operated	Total number	Operation				
		Full auto-matic	Semi auto-matic	Power	Hand	Un-known
0 per cent.....	37	-----	21	1	15	-----
1 to 10 per cent.....	10	-----	9	-----	1	-----
11 to 20 per cent.....	11	5	-----	-----	6	-----
21 to 30 per cent.....	19	3	11	-----	5	-----
31 to 40 per cent.....	27	1	26	-----	-----	-----
41 to 50 per cent.....	34	13	21	-----	-----	-----
51 to 60 per cent.....	18	-----	8	-----	10	-----
61 to 70 per cent.....	18	12	6	-----	-----	-----
71 to 80 per cent.....	89	12	72	5	-----	-----
81 to 90 per cent.....	5	4	1	-----	-----	-----
91 to 100 per cent.....	53	16	32	5	-----	-----
Unknown.....	32	16	9	1	5	1
Total.....	353	82	216	12	42	1

TABLE 33.—FLAT MACHINES OF VARYING WIDTHS, CLASSIFIED ACCORDING TO PER CENT PRODUCT STILL IN DEMAND

Width in inches	Total number	Per cent product still in demand						
		11-20	21-30	41-50	61-70	81-90	91-100	Un-known
8.....	22	-----	-----	1	-----	-----	21	-----
8 1/2.....	1	-----	-----	-----	-----	-----	-----	1
9 1/2.....	8	-----	-----	-----	-----	-----	-----	8
10.....	32	-----	11	-----	-----	-----	20	1
14.....	10	-----	-----	-----	-----	-----	10	-----
16.....	17	-----	-----	2	-----	-----	14	1
17.....	1	-----	-----	-----	-----	-----	1	-----
18.....	24	-----	-----	18	-----	-----	6	-----
19 1/2.....	1	-----	-----	-----	-----	-----	1	-----
20.....	28	1	-----	-----	-----	-----	25	2
21.....	1	-----	-----	-----	-----	-----	-----	1
22.....	7	-----	-----	2	-----	-----	4	1
23.....	2	-----	-----	-----	-----	-----	2	-----
24.....	66	8	-----	5	1	12	37	3
25.....	1	-----	-----	-----	-----	-----	-----	1
26.....	7	1	-----	1	-----	-----	4	1
27.....	1	-----	-----	1	-----	-----	-----	-----
28.....	19	2	-----	-----	-----	-----	17	-----
30.....	10	-----	-----	1	-----	-----	9	-----
31.....	2	-----	-----	-----	-----	-----	1	1

TABLE 33.—FLAT MACHINES OF VARYING WIDTHS, CLASSIFIED ACCORDING TO PER CENT PRODUCT STILL IN DEMAND—Continued

Width in inches	Total number	Per cent product still in demand						
		11-20	21-30	41-50	61-70	81-90	91-100	Unknown
32	24		1	10			12	1
33	1						1	
34	2							2
35	1						1	
36	20			9			11	
38	1						1	
39	2							2
40	4			1			3	
43	1						1	
43½	2						2	
44	13			6			7	
60	10		10				1	
61	1						1	
66	1			3				
72	3							
Unknown	7						7	
Total	353	12	22	60	1	12	220	26

TABLE 34.—FLAT MACHINES OF VARYING WIDTHS, CLASSIFIED ACCORDING TO PER CENT OF NORMAL WORKING TIME USED, 1929

Width in inches	Total number	Per cent of time operated											
		0	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	Unknown
8	22	1			1		13		2	5			
8½	1	1											8
9½	8									20			1
10	32				11				1	3		4	1
14	10			1									
16	17	2	1		1				12				1
17	1											1	
18	24			6		12			6				
19½	1							1					
20	28	2	1			1		4		4		11	5
21	1												1
22	7	2	2				1			1			1
23	2									1			
24	66	17	2		3		1	8	13	11	1	5	5
25	1			1									
26	7	1	1					1		1		3	
27	1				1								
28	19		1					4		2		14	
30	10				1		2		2	2		2	1
31	2									1			
32	24		1			1	6			13			3
33	1		1										
34	2				2							1	
35	1									7		5	1
36	20				2	1	4						
38	1									1			
39	2			2									
40	4						1			1	1		
43	1		1									2	
43½	2												
44	13						6				3	4	
60	10				10								
61	1												1
66	1												
72	3												
Unknown	7												
Total	353	37	10	11	19	27	34	18	18	89	5	53	32

TABLE 35.—FLAT MACHINES WITH VARYING NEEDLES PER INCH, CLASSIFIED ACCORDING TO PER CENT PRODUCT STILL IN DEMAND

Needles per inch	Total number	Per cent product still in demand						
		11-20	21-30	41-50	61-70	81-90	91-100	Unknown
2½	83		10	49			23	1
3	5			5				
4	8			2				
5	78	3	12				5	1
5½	2					12	44	6
6	52	1					51	
7	63			1				
8	48	6		1			47	15
9	1						39	2
10	5	2					1	
12	7			2			3	
Unknown	1						6	
Total	353	12	22	60	1	12	220	26

TABLE 36.—FLAT MACHINES WITH VARYING NEEDLES PER INCH, CLASSIFIED ACCORDING TO PER CENT OF NORMAL WORKING TIME USED, 1929

Time operated	Total number	Needles per inch											
		2½	3	4	5	5½	6	7	8	9	10	12	Unknown
0 per cent	37	7											
1 to 10 per cent	10	1		1	17		4	4	3			2	
11 to 20 per cent	11	1	5		4			1	3			1	
21 to 30 per cent	19	10		6	2		1						
31 to 40 per cent	27	12		12			1	1					
41 to 50 per cent	34	20		1					13				
51 to 60 per cent	18				5		1	4	4		2	2	
61 to 70 per cent	18				15								
71 to 80 per cent	80	18			9	2	42	10	3	7	1		
81 to 90 per cent	5				2								
91 to 100 per cent	53				6		2	27	13		3	2	
Unknown	32	14			2		1	13	1				1
Total	353	83	5	8	78	2	52	63	48	1	5	7	1

TABLE 37.—FLAT MACHINES WITH VARYING NUMBER OF STRIPER CHANGES, CLASSIFIED ACCORDING TO PER CENT PRODUCT STILL IN DEMAND

Product still in demand	Total number	Striper changes					
		0	1	2	2 or 3	3	Unknown
11 to 20 per cent	12		9	1			
21 to 30 per cent	22		11				2
41 to 50 per cent	60		26	24	1		
61 to 70 per cent	1						9
81 to 90 per cent	12						
91 to 100 per cent	220	90	41	48	12		
Unknown	26	12	6	6		32	9
Total	353	148	83	55	12	35	20

TABLE 38.—FLAT MACHINES WITH VARYING NUMBER OF STRIPER CHANGES,
CLASSIFIED ACCORDING TO PER CENT OF NORMAL WORKING TIME USED, 1929

Time operated	Total number	Striper changes					
		0	1	2	2 or 3	3	Unknown
0 per cent.....	37	23	12				2
1 to 10 per cent.....	10	3	4			3	
11 to 20 per cent.....	11	6	1	4			
21 to 30 per cent.....	19	6	10			3	
31 to 40 per cent.....	27	14	12			1	
41 to 50 per cent.....	34	29	4	1			
51 to 60 per cent.....	18	11	6			1	
61 to 70 per cent.....	18	3	2	1	12		
71 to 80 per cent.....	89	26	22	14		9	18
81 to 90 per cent.....	5		1			4	
91 to 100 per cent.....	53	18	9	13		13	
Unknown.....	32	9		22		1	
Total.....	353	148	83	55	12	35	20

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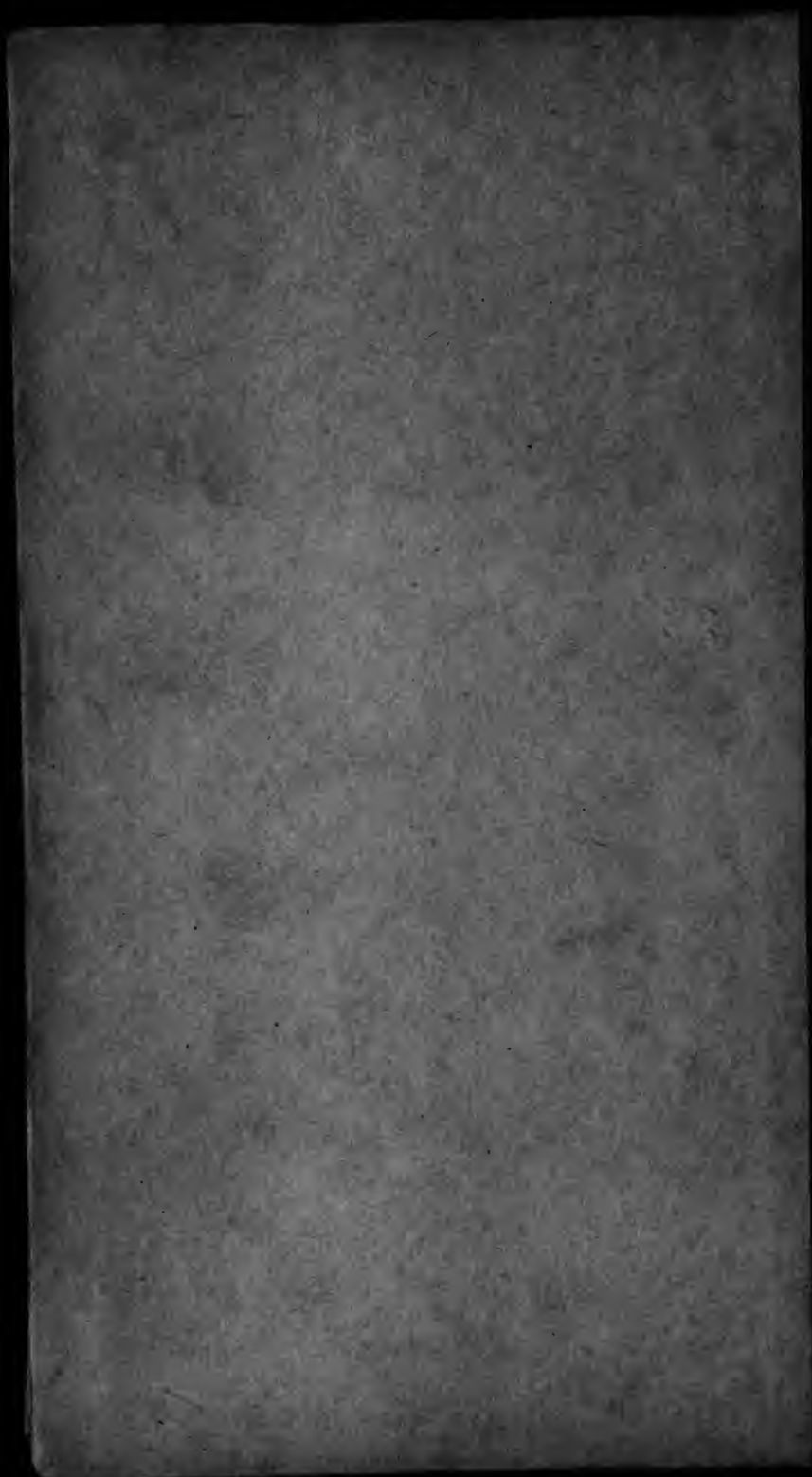
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